The Ohio State University EcoCAR Program: Paving the Future for Sustainable Transportation

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1/24/2019

ECOCAR

THE OHIO STATE UNIVERSITY

CENTER FOR AUTOMOTIVE RESEARCH

Introduction

Position: Communication Manager
Major: Communication
Year: Junior

Position: Control System Modeling and Simulation Lead
Major: Mechanical Engineering
Year: Senior

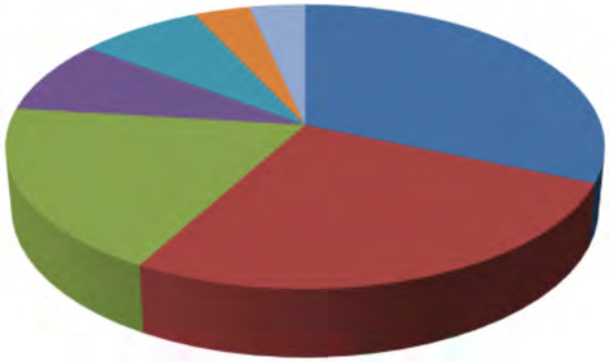
Overview

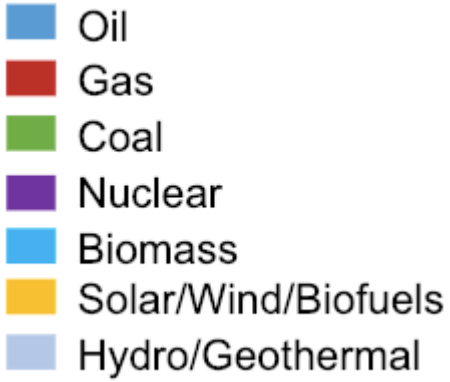
- The current state of transportation
- Ohio State students determine mobility solutions through the EcoCAR program
- EcoCAR members leverage outreach to maximize impact and promote a greener future

Energy Source Distribution

2010

2040 Projections





While oil, gas, and coal are expected to hold **77 percent of the global energy share** in 2040, innovations within the automobile industry offer hope for both consumers and the environment

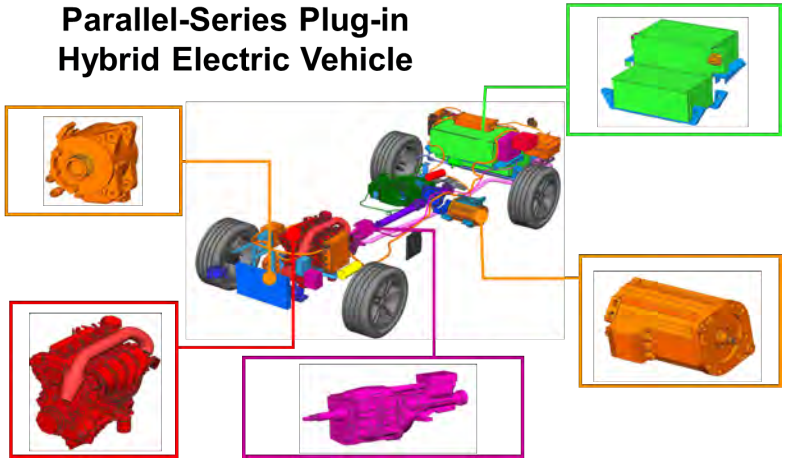
Source: Eia.gov. (2015). The Outlook for Energy: a View to 2040. [online] Available at: https://eia.gov/tools/faqs/faq.php?id=23&t=10 [Accessed 7 Jan. 2019]

Current State of Transportation

Transportation is 96 percent dependent on petroleum and with over one billion cars on the world's roadways, there are zero signs that this trend will subside

391.71 million gallons of gasoline are consumed each day, equating to **142.98 billion gallons** per year

Ohio State Students Explore Mobility Solutions



- Hybrid vehicles are increasing in market share and offering consumers the opportunity to **reduce their environmental footprints**

- Students at Ohio State are leveraging AVTC involvement to explore mobility solutions, prioritizing safety, efficiency and sustainability along the way

Source: Eia.gov. (2018). *How much Gasoline does the United States consumer?.*. [online] Available at: https://eia.gov/tools/faqs/faq.php?id=23&t=10 [Accessed 7 Jan. 2019], Businesswire.com (2018). Global Hybrid Car Market: Industry Analysis, Trends, Market Size and Forecasts up to 2024. [online] Available at: https://www.businesswire.com/news/home/20180713005268/en/Global-Hybrid-Car-Market-Industry-Analysis-Trends [Accessed 7 Jan. 2019].

Advanced Vehicle Technology Competition

For more than 28 years, the U.S. Department of Energy (DOE) has sponsored 11 Advanced Vehicle Technology Competitions (AVTC) in partnership with the North American auto industry.

*More than **16,500 students** have graduated from an AVTC*

***93 universities** throughout North American have participated in an AVTC*

*More than **165 corporations** have contributed to an AVTC over 28 years*

Classic. *Recharged.*

Our team reengineered a 2016 Chevrolet Camaro into a performance hybrid-electric vehicle.

Engineering Goals:

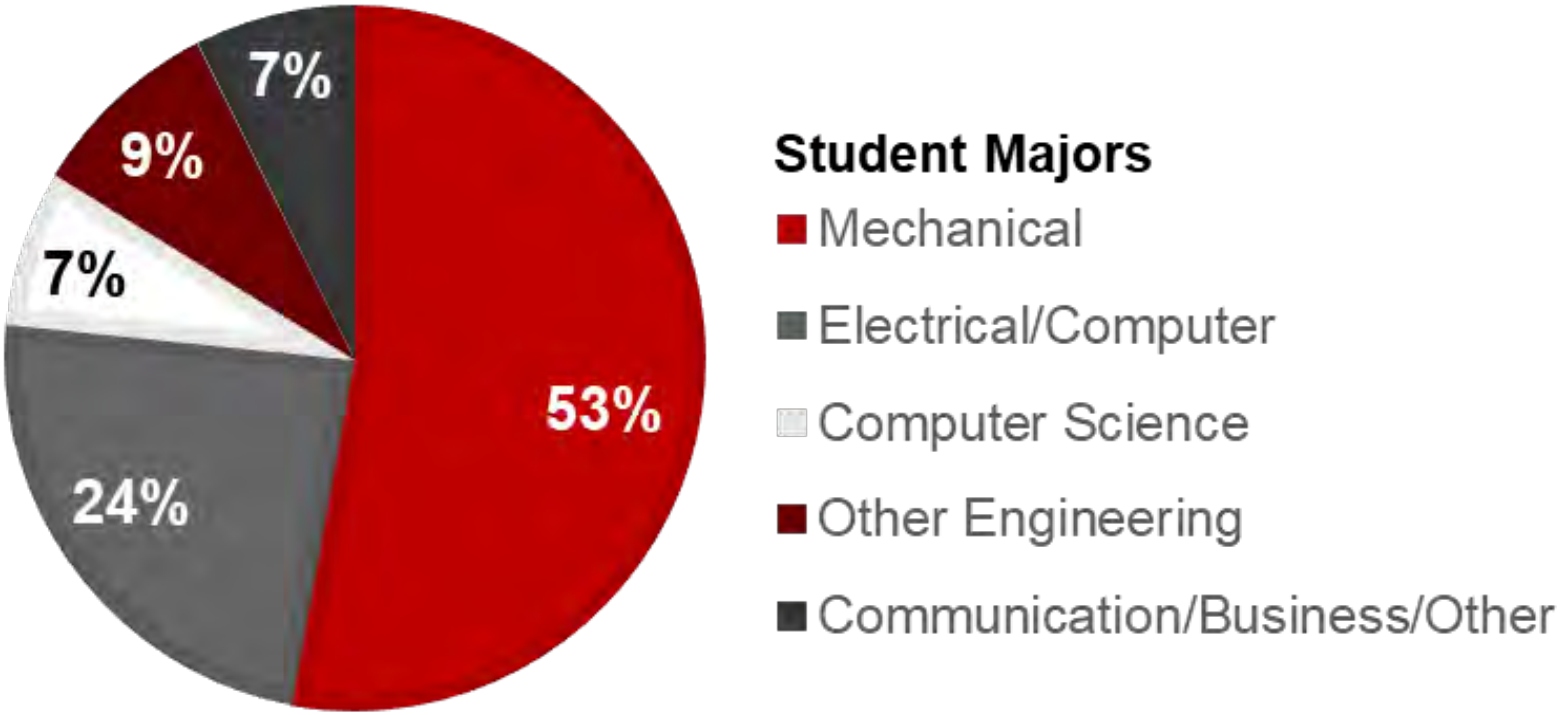
- Increase fuel economy
- Reduce emissions and energy consumption
- Maintain performance and consumer acceptability

OSU EcoCAR Introduction

OSU EcoCAR Team

Team Statistics:

200+ Engineering Students Participating with OSU EcoCAR3



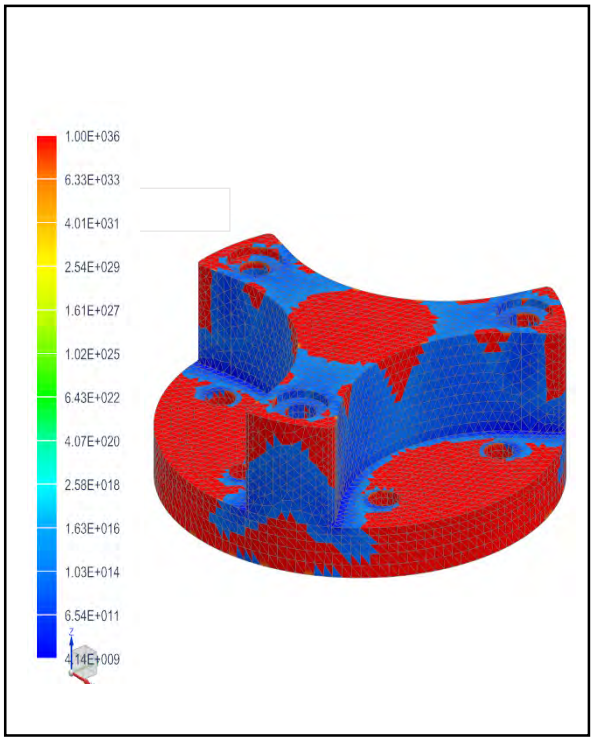
Diversity

Diversity in race, gender, and national origin on our team **encourages new perspectives** and **fosters stronger education**.

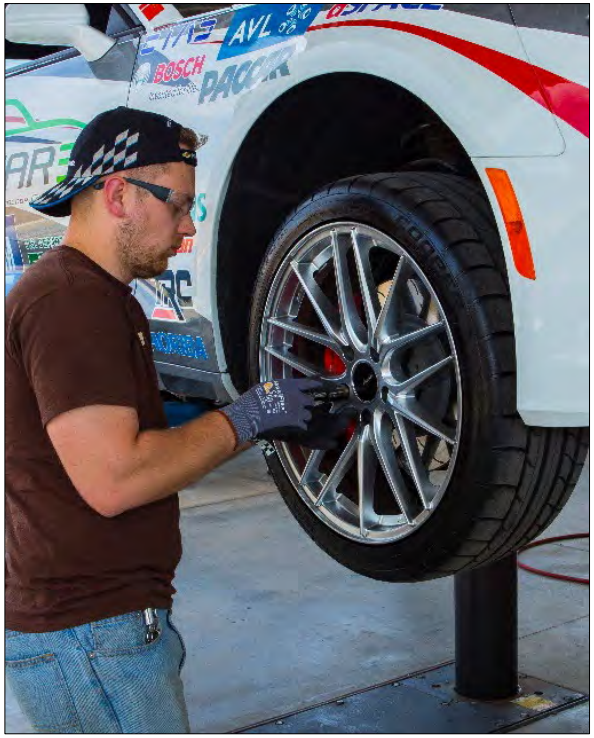
Diversity Awards

- ***Five*** Diversity and Inclusion in Engineering Awards
- ***Four*** Women in Engineering award winners

Students…



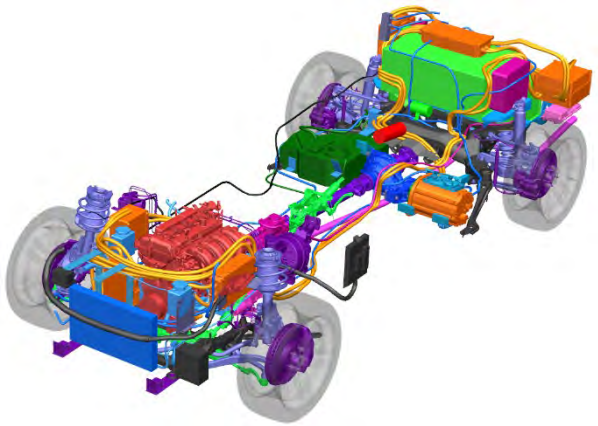
Designed

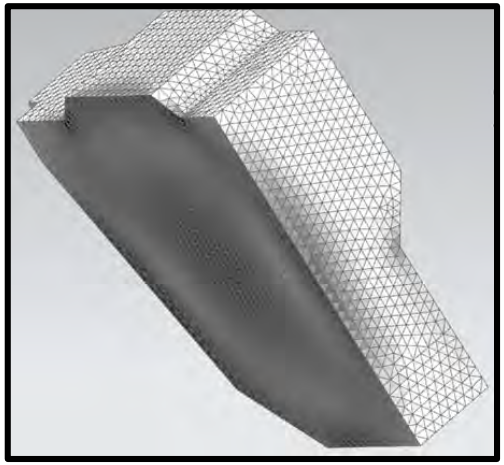


Built

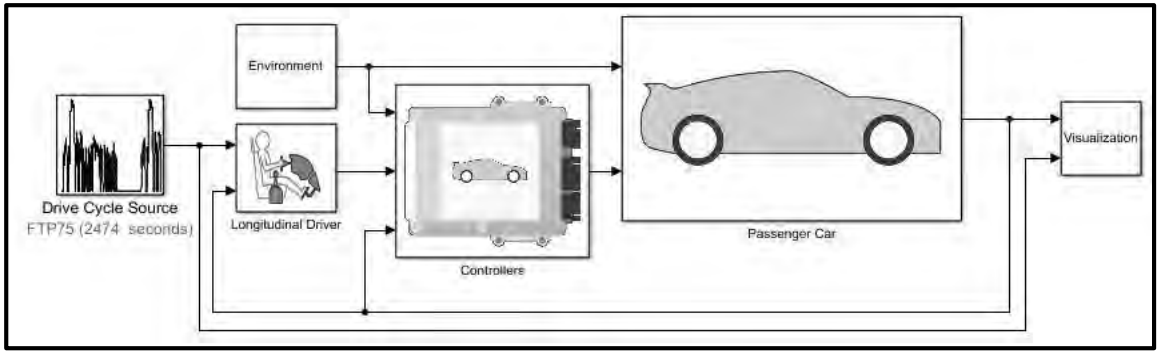
Tested

Design





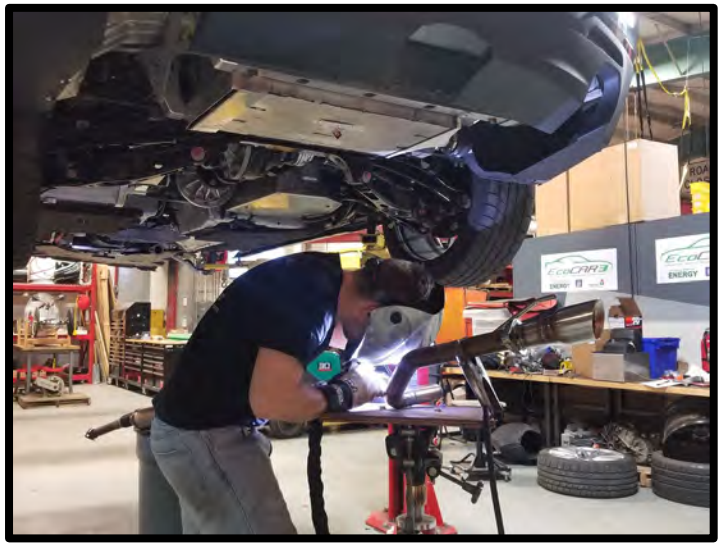
Mechanical: Computer Aided Design (CAD) Space Claim Analysis & Physics Based Simulations



System Modeling and Simulation: Design and Simulating Vehicles with Different Components

MathWorks®

Construction and Integration



Testing and Calibration

Engine Dyno Testing

Chassis Dyno Testing

Vehicle Testing at Transportation Research Center (TRC)

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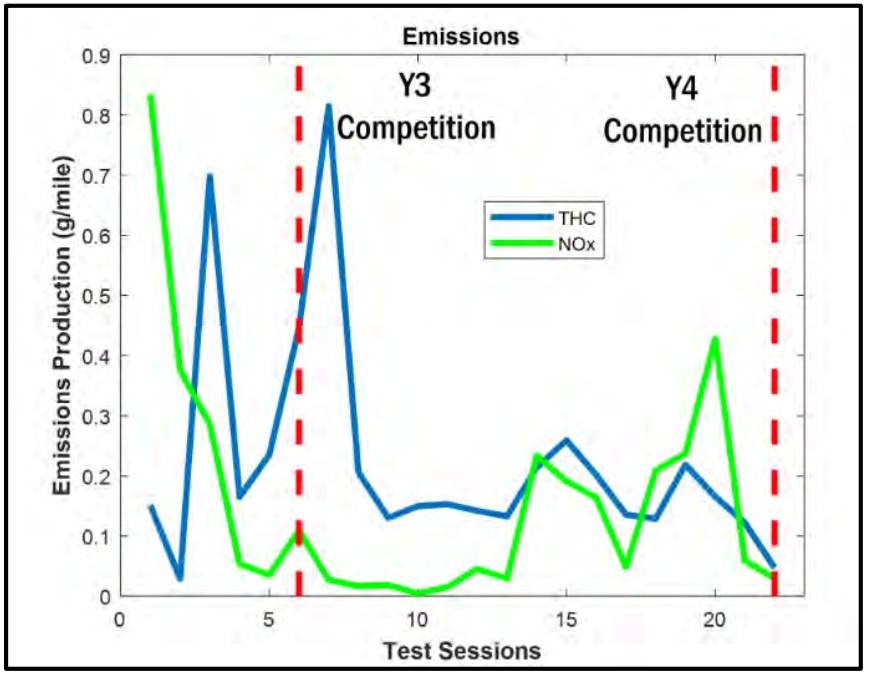
Fuel Economy

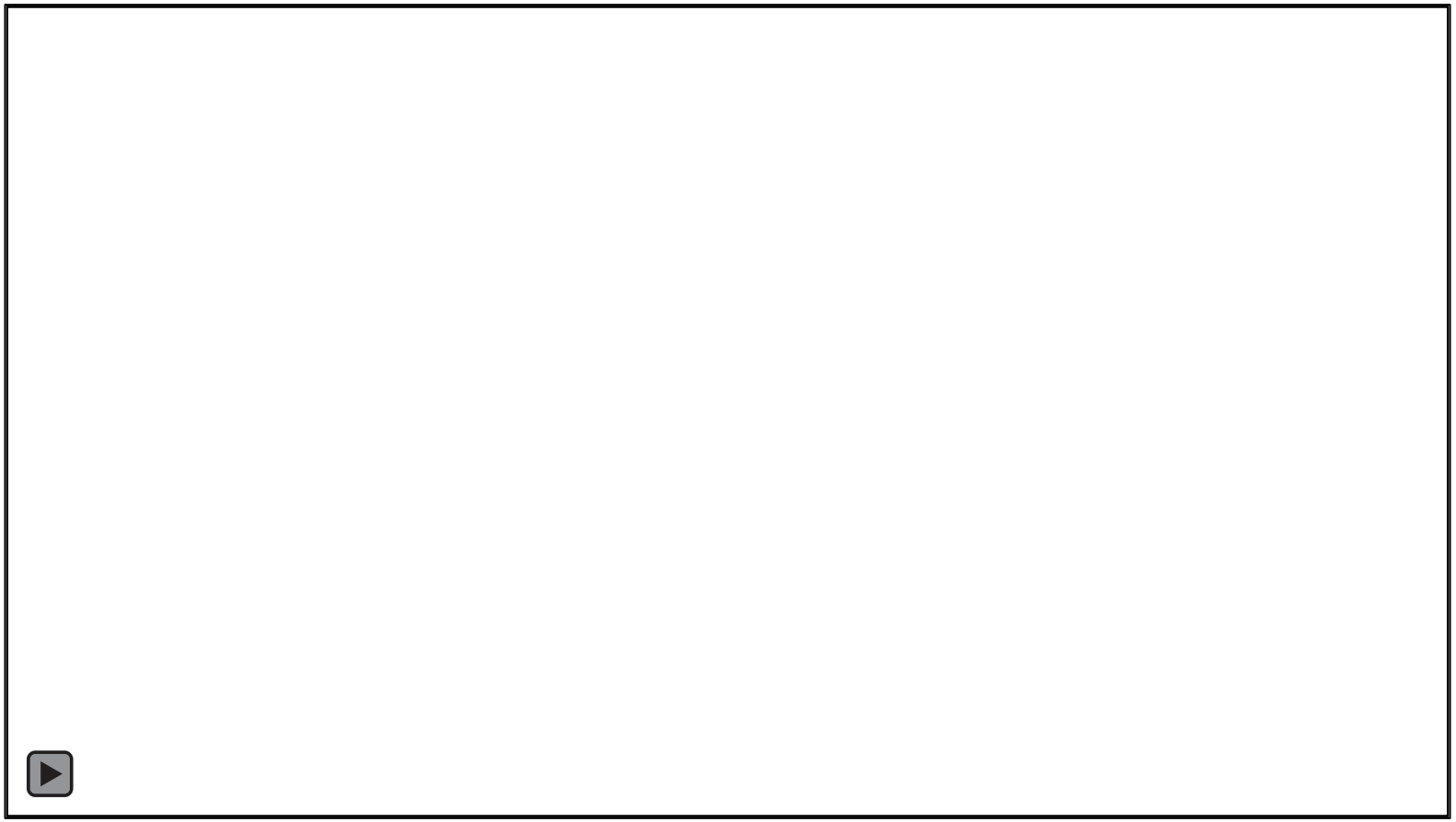
- **40** Miles All Electric Range
- **40** Miles Per Gallon Gasoline Equivalent
- **9.3%** Improvement from Year 3 to Year 4

Emissions



Team was able to reduce THC and NO_x emissions by a combined **80%**

Performance



0-60 MPH Acceleration in **6.2** Seconds

Competition Results

FIVE CONSECUTIVE FIRST-PLACE FINISHES

OSU AVTC teams have finished in the top five teams for 10 years.

25+ YEARS OF PARTICIPATION

The Ohio State University has been participating in AVTCs since 1990.

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Community and Industry Partnerships

ECOCAR

Industry Partnerships

COMPETITION ORGANIZERS

COMPETITION-LEVEL SPONSORS

MathWorks | National Science Foundation | California Air Resources Board
NXP Semiconductors | AVL | Bosch | ETAS | PACCAR | dSPACE | Snap-on | Siemens
GKN Driveline | Transportation Research Center | DENSO | Champlain Cable | Woodward | Proterra | Ricardo Mentor
Automotive | New Eagle | Gage Products | Electric Power Research Institute
A123 Systems | Flextronics | Samsung, SDI

TEAM-LEVEL SPONSORS

The Ohio State University College of Engineering | The Ohio State University Center for Automotive Research
Parker Hannifin | Cooper Tire | Clean Fuels Ohio | Transportation Research Center | Ford | Honda
TE Connectivity | Adient | Schaeffler | TREMEC | 3DParts.com | Modern DriveLine | PPG

Community Outreach

22,525 people** reached through **51 events** in four years over **five states

Through **community events**, our team:

- Reached communities across five states throughout the Midwest
- Educated individuals about green automotive technology
- Proved that a hybrid vehicle can come in a fun, performance package
- Promoted alternative-energy vehicles

Youth Outreach

***1,478 youth** reached through **23 events** in the community for the past five years*

Through **youth events**, our team has:

- Introduced new engineering concepts to young students
- Encouraged individuals to pursue STEM careers
- Exposed students to new skills using hands-on STEM activities

Government Outreach

Highlights include:

- Attending the SAE Government/Industry Meeting in Washington, D.C.

- Visiting **The Ohio Statehouse**

- Traveled to Washington, D.C. to meet with congressmen including Senator **Sherrod Brown** and Representative **Bob Gibbs**

Team members meet with Stan Skocki, Associate Vice President - Government Affairs & Director, Federal Relations

*Engaged **30+ government officials** over four years*

EcoCAR Mobility Challenge

The next Iteration of a 4-year Advanced Vehicle Technology Competition (AVTC) challenges 12 university teams to rebuild a 2019 Chevrolet Blazer

Engineering Goals:

- Increase fuel economy
- Integrate Connected and Automated Technologies
- Target the Mobility-as-a-Service Market

Looking to the Future

EcoCAR will continue to work towards developing the next generation of engineers, equipping them with the skills to create mobility solutions with the **environment,** the **industry** and the **consumer** in mind.

This program will continue to foster partnerships in the **community**, **government**, and **industry** in pursuit of a greener future.

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